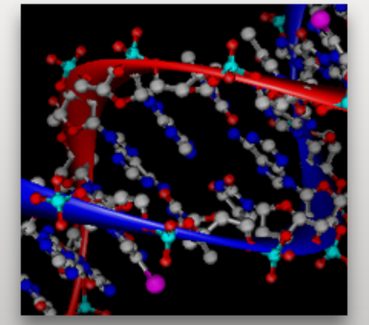
Creating Drivers for USB Devices

Session 509

These are confidential sessions—please refrain from filming or taking pictures.



OS Foundations

Creating Drivers for USB Devices

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Not Your Regular Old Session

- Tiger highlights
- Hands on driver development
  - More like a USB Kitchen
  - Tools we use
  - Pitfalls we've encountered
  - Debug session
  - Cross fingers

Tiger Highlights

Matching Criteria

- Common Class Specification device driver ranking

idVendor | idProduct | bcdDevice

idVendor | idProduct

Vendor-Specific Class

idVendor

bDeviceProtocol | bDeviceSubClass

idVendor

bDeviceSubClass

Not Vendor-Specific Class

bDeviceClass

bDeviceSubClass | bDeviceProtocol

bDeviceClass

bDeviceSubClass

Wild Card Matching

New in Tiger

- What if you wanted to match to all devices from one vendor?
  - Multiple personalities
  - Error prone
  - Need to update when new devices come out
- Wild Card Matching
  - Allows any field to match “all” values
  - Probe score is reduced
  - Partial wild card as well

Wild Card Matching

Sample vendor specific device driver

idVendor | idProduct | bcdDevice

idVendor | **idProduct**

Vendor-Specific Class

idVendor | bDeviceProtocol | bDeviceSubClass

idVendor | bDeviceSubClass

Not Vendor-Specific Class

bDeviceClass | bDeviceSubClass | bDeviceProtocol

bDeviceClass | bDeviceSubClass

Wild Card Matching

Sample device driver matching to all products for a particular vendor

idVendor | idProduct | bcdDevice

idVendor = 0x05ac | **idProduct = "*"**

Vendor-Specific Class

idVendor

bDeviceProtocol | bDeviceSubClass

idVendor

bDeviceSubClass

Not Vendor-Specific Class

bDeviceClass

bDeviceSubClass | bDeviceProtocol

bDeviceClass

bDeviceSubClass

Tiger Highlights

USB Bus Topology Reminders

- Full speed devices downstream of a high speed hub
  - Multi-TT hubs
  - Split transactions
  - Watch out for periodic endpoints and bandwidth allocation
    - Isochronous in and out
    - Interrupts
  - Split Isoch Timing is totally different in 10.3.9 and Tiger
    - Isoch Out will happen towards the end of the frame
    - Isoch IN will still happen towards the beginning of the frame
- Debug problems by attaching to root hub of full speed hub
  - NEC EHCI Controller has 2 OHCI and 1 EHCI controllers

Live Debugging (Gulp!)

Demonstrate use of debugging tools

- Use a device to go through sample code
  - Discover the device's interfaces
  - Look at the properties for the endpoints
  - Read data from interrupt endpoint
- Show use of chained reads (performance)
  - Using bulk UVC Camera

Tools That We Use

Logging version of the IOUSBFamily

- GM strips all logs except fatal
- Logging version posted shortly after updates
  - http://developer.apple.com/devicedrivers/usb
  - Contains headers and examples (SU does NOT)
- You can use USBLogs in your kernel code
- When debugging sleep/wake or startup kernel issues use kprintf from the Firewire SDK

Demo

USB Prober

http://developer.apple.com/wwdc2005/

Tools That We Use

USB Prober

- Bus Probe gets the descriptors manually, not using what the stack did
- Points out some firmware bugs
- We display the raw descriptor as well
- Complex descriptors (Audio/Video) might have some issues
- IORegistry pane to see bus topology and drivers
- USB Logger pane
  - Usually use level 5 or 6
  - Level 7 only for short sample periods
  - Lower level and change the level to isolate issues

Tools That We Use

Two-machine debugging

- Don’t worry, we will not attempt to Demo
- See session 505: Developing Reliable and High Performance Drivers for Mac OS X Tiger
- Sometimes the only way and you need to know how to decode panics

Tools That We Use

User space

- Much easier!
- XCode and symbolic debugging, easy to get used to
- Can build IOUSBLib and trace into it
- Don’t have to reboot
- Sometimes printf’s are needed
  - Multiple threads
  - Callbacks

Tools That We Use

USB Bus Analyzer

- See Common Q&A and Roadmap for USB Software Development on Mac OS X
  - http://developer.apple.com/qa/qa2004/qa1370.html
- When in doubt
  - What is happening on the bus
  - Is the transaction going out on the bus?
  - Is the device sending data?
  - Is it the right format?
- We have a CATC Mobile HS

Demo

Getting the most out of your USB device

Fernando Urbina

http://developer.apple.com/wwdc2005/

More Information

http://developer.apple.com/wwdc2005/

Documentation, Sample Code, and Other Resources

http://developer.apple.com/wwdc2005/

Related Sessions

Developing Reliable and High Performance Drivers for Tiger	Session 505 Tuesday 3:30PM
Mac OS X Lab: Adding HID Support to Applications	Lab Thursday 3:30PM
Mac OS X Lab: Kernel Extensions	Lab Thursday 2:00PM

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